REMARKS

Election Requirement

Applicant affirms the election, with traverse, to prosecute the invention of Group I, Claims 1, 36-38 and 59, per the telephone conversation with Examiner Heitbrink on September 24, 2002. Applicant reserves the right to pursue the patentability of the subject matter of the non-elected claims.

The restriction requirement is respectfully traversed for the following reasons. The Examiner objects that there is a lack of unity of invention, on the basis that the application contains claims directed to more than one species of the generic invention. The Examiner identifies four groups of claims, and contends that they do not relate to a single general inventive concept because they "each have a different special technical feature which is usable alone".

Whether or not this is the case, it is submitted that the relevant test is rather that the claims share a *common* special technical feature, and this they do. It is important to understand the fundamental motivation behind the present invention. The present invention aims to provide to industry as practical a method of automated machine optimization as possible. This means communicating directly with the machine controller to change set machine parameters for the velocity and pressure phases, and using standard machine sensors to gather information on how the machine is controlling these machine parameters. This means that the technology will be transparent to the user, that is, there should be no need to change the way the machine is fundamentally used. As a result, the method can be

B

used as a complementary technology with existing machines, without interference with standard the working practice of the factory in which the machine is situated.

This can readily be distinguished from prior art techniques, in which it is necessary to retro-fit sensors to the mold or injection nozzle so that data can be gathered during the injection process, in particular pertaining to the filling, packing and holding phases; these prior art techniques then employ controls that by-pass the machine's standard control system (and which, as an aside, may violate the machine's safety systems) on the basis of the gathered data. Further, tool change times are increased, which may in fact counteract any benefit derived from the automation process.

Thus, the present invention as defined in the claims is linked by the special technical feature that the various aspects use only data that are accessible to the user without modifying the machine. These data may be derived from visual inspection of molded parts (e.g. claim 1) or from the pressure or velocity profiles. The invention then deduces aspects of the behavior of the machine from these data, without interfering with the machine at those lower levels. (Pressure and velocity profiles, it will be understood, are parameters that are controlled by the machine and do not require the use of extra sensors.) The present invention thus taps into existing, available data and deduces what is happening further down-line rather than through direct measurement. This constitutes a novel special technical feature unifying the claims.

Furthermore, the present invention is that it should be suitable for use with modern data collection and processing techniques and, specifically, with real time data traces. For this reason, the present invention is designed to be suitable for use with a real time

B

interpretation of screw movement and injection pressure characteristics (parameters, again, available without machine modification). This technical feature is evident from and implicit in the various method steps defined in the claims. This is not to suggest that *every* step of each claim can be performed in this fashion: for example, inspecting parts for defects will still typically be performed by eye.

In addition, the invention defined in claims 1, 2 and 33 shares the additional unifying special technical feature of providing optimization in the velocity phase of injection molding. This may be compared to prior art methods, including those of the cited documents, in which optimization is taught only during phases *other* than the velocity phase. This is a subtle but significant distinction. For example, one can consider cited US Patent No. 5,900,259 (Miyoshi, et al.). This document makes no reference to the filling phase; rather, as is typical of prior art approaches, it merely distinguishes between "a filling phase" and "a packing phase" (see column 3 lines 17 and 18). ("Phase" rather than "stage" is employed in the following discussion, but it should be understood that "phase" and "stage" are interchangeable in this context.) In the prior art, it is common to ignore any distinction between the filling phase and the velocity phase, or between the packing phase and the pressure phase. However, understanding the distinction forms an important part of the present invention as defined in claims 1, 2 and 33 (and claims depending therefrom).

The velocity phase generally ends before completion of the filling phase, so that the pressure phase commences while the filling phase is still in progress. Similarly, the pressure phase does not cease when the packing phase (a compression phase used for

6

dimensional control) is complete, but rather continues through the subsequent holding phase: this latter point is discussed from page 3 line 21 of the present application, where it is explained that the holding phase forms the second part of the pressure control phase and continues while cooling and shrinkage occurs until the gates (or injection entry points) are frozen.

None of the cited prior art documents refers to this distinction or teaches (whether alone or in isolation) an optimization technique for optimizing in the velocity phase. However, as it apparent from step (4) of original claim 1 (relating to adjusting injection velocity), step (3) of claim 2 (relating to measuring injection velocity as a function of a lapsed injection of time and determining a profile therefrom), and step (2) of claim 33 (relating to determining an optimum injection velocity profile), these claims all recite the use of the velocity phase through control of the injection velocity profile in achieving optimization. It is submitted that this feature is a common special technical feature linking these claims, and consequently linking at least Groups I and II and the claims said to be generic. For these reasons at least, it is submitted that the restriction requirement is improper, and its withdrawal is earnestly solicited.

Rejection Under 35 U.S.C. § 112, Second Paragraph

Claims 1, 36-39 and 59 were rejected under 35 U.S.C. § 112, second paragraph, as indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. In the Office Action, it is contended that step 4 of Claim 1—according to the present wording—may not occur. The steps in Claim 1 have

been amended to include "inspecting said part for defects." Consequently, amended steps (2) and (3) will be carried out at least once.

Claims 38 and 59 have been amended to remove the wording "or any other."

It is further contended in the Office Action that Claim 38 is unclear as to the use of the injection pressure in the steps of claim 1, and it is suggested that the claim may have been intended to be dependent from claim 2. Claim 38 has been amended to depend from Claim 2; similarly, Claim 59 has been amended to depend from Claim 33.

It is contended that "said injection cylinder hydraulic pressure" in Claim 39 lacks adequate antecedent basis. Claim 39 has been amended to depend directly from Claim 2, thereby obviating the antecedent basis issue.

Claim 36 has also been amended to address the antecedent basis issue, and to correct the obvious typographical error "of" for "or", and corresponding amendments have been made to Claim 58.

Art Rejection Under 35 U.S.C. § 103(a)

Claims 1, 36-39 and 59 were rejected under 35 U.S.C. § 103(a) as unpatentable over Hunkar, et al. (U.S. Pat. No. 3,767,339; hereinafter, "Hunkar") taken together with Myoshi, et al. (U.S. Pat. No. 5,900,259; hereinafter, "Myoshi") and Hettinga, et al. (U.S. Pat. No. 5,898,591; hereinafter, "Hettinga").

It is respectfully submitted that Hunkar does not in fact disclose a method of automated optimization of the set-up process for an injection molding machine. Rather, the disclosure of Hunkar relates to the use of closed-loop feedback during an actual injection

B

process, for controlling the ram velocity with the aim of ensuring that the conditions prescribed by the original set-up are attained. The superficial resemblance between the disclosure of Hunkar and the present application is possibly due to Hunkar's reference to injection velocity and ram position, but Hunkar in no way addresses how one might establish—in an automated process—that initial machine set-up.

The Examiner observes that Hunkar discloses a process of adjusting the injection stroke and injection velocity based on observations of the injection process "which correlate to defects in the product". However, this comparison with the present invention is more apparent than real. The closed-loop feedback of Hunkar attempts to ensure that the injection proceeds as initially intended, but the success of that process will be limited by that initial set-up. Consequently, Hunkar's process will not guard against the production of defective products, but rather merely against the incorrect implementation of the initial set-up. The present invention, on the other hand, actively reduces or eliminates defects at the set-up stage by optimizing that set-up in the manner defined in the claims. It is submitted, therefore, that the teaching of Hunkar are not relevant to the present invention.

In any event, the algorithm taught by Hunkar are not comparable to the method used in the various aspects of the present invention, as set forth in the amended claims. Further, because Hunkar relates to the adherence of the actual injection process to an original set-up, its teaching differs fundamentally from the technical solutions taught by Miyoshi and by Hettinga. These last two patents do, indeed, address the technical problem of automated optimization of molding machine set-up, but consequently the skilled person

B

would have no reason to combine either of their teachings with that of Hunkar. Therefore the motivation component of a proper obviousness rejection is missing.

More specifically, Miyoshi describes a general system for computer-assisted automated set-up. This system optimizes the injection process based on a computerized plastic flow analysis, then makes observations of an actual process, corrects model parameters to better match experimental observation, optimizes the corrected model, and so forth. Miyoshi, however, does not disclose a feedback process based on observation of actually molded articles or machine parameters; Miyoshi instead restricts this analysis to observed *injection* data. Thus, data pertaining to particular molding parameters, such as temperature, are gathered during one iteration and fed into a subsequent iteration to improve modeling—and therefore set-up—accuracy. Thus, the assumed constant temperature shown in figure 7 is, following one iteration, replaced in the calculations with the *actual* temperature shown in figure 8 (see column 11 from line 21). As discussed above, the present invention employs—in all of its aspects—the observation of molded articles or of machine parameters, not of injection data.

Consequently, it is submitted that the disclosure of Miyoshi differs fundamentally from the approach adopted by the present invention.

Further, as is explained in the Abstract, Miyoshi discloses a system in which the "plastic flow condition optimizing section carries out a plastic flow analysis on a molded part model, and determines an optimum flow condition in a filling stage and a packing stage of an injection molding process...." As explained above, the present invention teaches methods that exploit the characteristics of the velocity phase and the pressure phase. These

phases are not the same as the filling phase and the packing phase, and the distinction—though subtle—is important to the operation of the method of the present invention. Consequently, the disclosure of Miyoshi actually *teaches away* from this aspect—defined in the claims—of the present invention. The ordinarily skilled artisan could not, therefore, arrive at the present invention on the basis of the teaching of Miyoshi, taken singularly or in combination with Hunkar (and Hettinga, as explained below).

Hettinga describes a general system that consists of an injection molding machine and a computer, provided with the ability to upload and download process profiles and "at least one algorithm" of altered process parameters according to molding defects.

However, this prior art document is solely concerned with the use of a computer to control the injection molding machine, whereby the injection process can be modified by a human operator using menu items 110 (column 5 line 58) so that more information may be provided to the computer 74. This document makes no disclosure of how one should respond to particular defects. It merely refers to the various parameters that affect plasticization (see column 6 lines 33 to 37) in general terms. Hettinga does not teach an automated set-up method, but rather a system by which a human operator may readily alter such a set-up through the uploading of existing algorithms.

Thus, Hettinga at most suggests that one may improve the optimization process by observing defects obtained during actual injections, but neither Hettinga nor Miyoshi in any way suggests the particular solution to this problem defined in the amended claims of the present application. Further, the ordinarily skilled artisan would not be motivated to combine either Miyoshi or Hettinga with Hunkar in the manner suggested in the Office

B

Action, owing to the distinct technical problems addressed by the respective references. The withdrawal of the obviousness rejection based on these references is therefore respectfully requested.

Conclusion

In view of the preceding discussion, Applicant respectfully urges that the claims of the present application define patentable subject matter and should be passed to allowance. Such allowance is respectfully solicited.

If the Examiner believes that a telephone call would help advance prosecution of the present invention, the Examiner is kindly invited to call the undersigned attorney, Mr. Khaled Shami, at (650) 622-2332.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

By: ______________________

Khaled Shami
Registration No. 38,745

P.O. Box 1404
Alexandria, Virginia 22313-1404
(650) 622-2300

Date: April 1, 2003

Attachment to Amendment dated April 1, 2003

Marked-up Copy of Claims as Amended

The claims have been amended as follows:

1. (Amended) A method for the automated optimization of an injection molding machine set-up process, said machine for manufacturing injection molded parts, including the steps of:

(1) manufacturing one or more parts with said machine;

(2) inspecting said parts for defects[;], and

[(3)] reducing injection stroke in response to any flashing or increasing injection stroke in response to any short shots; and

[(4)](3) inspecting said parts for defects, and reducing injection velocity in response to any flashing or increasing injection velocity in response to any short shots[,];

wherein either step [(4)](3) is employed after step [(3)](2) if step [(3)](2) is found to have substantially no effect or substantially no further effect, or step [(3)](2) is employed after step [(4)](3) if step [(4)](3) is found to have substantially no effect or substantially no further effect, thereby reducing said defects.

36. (Amended) A method as claimed in claim 1, including:

determining [said machine's] a velocity control response time for said injection molding machine, and

employing time steps equal to [of] or greater than said velocity control response time.

Attachment to Amendment dated April 1, 2003

Marked-up Copy of Claims as Amended

38. (Amended) A method as claimed in claim [1]2, wherein nozzle melt pressure, injection cylinder hydraulic pressure, or forward propelling force applied to said screw[, or any other measure proportional to or equal to said nozzle melt pressure,] is used as a measure of, in place of, or to determine, said injection pressure.

39. (Amended) A method as claimed in claim [38]2, wherein [said] injection cylinder hydraulic pressure is used as a measure of or to determine said injection pressure.

58. (Amended) A method as claimed in claim 35, including:

determining [said machine's] a velocity control response time for said injection molding machine, and

employing time steps equal to [of]or greater than said velocity control response time.

59. (Amended) A method as claimed in claim [37]33, wherein nozzle melt pressure, injection cylinder hydraulic pressure, or forward propelling force applied to said screw[, or any other measure proportional to or equal to said nozzle melt pressure,] is used as a measure of, in place of, or to determine, injection pressure.

B